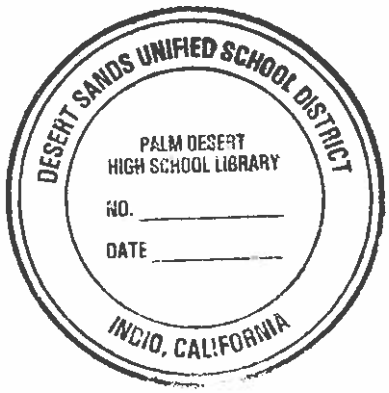
HANDS IN CLAY

FOURTH EDITION



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1

An Introduction to Clay

Clay feels soft and pliable in your hands. Pick up a lump of it, let your fingers respond to its **plasticity,** and as you pinch and poke, the clay seems to have a life of its own, to which your fingers respond. With these pinching gestures, you are repeating the actions of untold numbers of humans who have worked with clay even as far back in time as the Ice Age, 37,000 to 12,000 years ago. The earliest known examples of clay objects formed by human hands are unfired representations of animals modeled on a moist clay bank in a cave in France and some fired clay animals, female human figures, male figures, and others of no specific gender found at an Ice Age site in eastern Europe (1-1).

This very early use of fire to harden clay, though it predated the oldest **pottery** yet found, was apparently localized. Some pottery, like the proto-Jomon (1-2) in Japan, has been dated at more than 12,000 years ago, and shards of pottery dating to about 10,000 years ago have been found in North Africa.

In excavations of early sites around the world, archaeologists have frequently dug up small fired clay figures of women. While their exact purpose is unknown, the clay figures are believed to have had a magical or religious purpose. Since many of these have been excavated in domestic rather

Figure 1-1
This figure, named "The Venus of Dolni Vestonice" for the Ice Age site where it was found in South Moravia, is one of the earliest known fired sculptures. It was discovered in a vaulted clay structure, believed to be a kiln. Ht. 4½ in. (11 cm). c. 25,000 B.C. *Courtesy of the Moravian Museum, Anthropos Institute, Brno.*

Figure 1-2
Unearthed from Ishigoya cave, Suzuka city in the Nagano prefecture, Japan, this vessel is among the most ancient pottery yet found—about 10,000 A.D. The pottery of this period is called Incipient Jomon, because this recently discovered pottery predates earlier finds. *Courtesy of the Museum of Archeology, Kokugakuin University, Tokyo, Japan.*

than sacred sites, they may, however, have served other purposes.

The knowledge and technique necessary to transform damp clay into a **ceramic** material developed at various times in different cultures, but no matter where the craft evolved, it influenced the development of that culture. For example, the knowledge of **ceramics** allowed villagers to make vermin-proof storage jars, which meant they could store grain against future crop failures and accumulate surpluses with which to trade with neighboring communities.

The new craft of ceramics depended on the exploitation of several intrinsic qualities of clay—its plasticity, its ability to hold the shape into which it is formed as it dries, and the fact that heating it to **maturity** transforms it into a new, permanently hard substance. Learning to control fire and using it to create this new material was one of humanity's first great technical achievements. In many cultures, ceramics developed along with the craft of metallurgy, with the discoveries in each technology aiding the other.

A RECORD OF HUMANITY IN CLAY

The close relationship between human hands and clay, along with the fact that a ceramic object is indestructible unless it has been crushed into such minute fragments that it cannot be repaired, has made it easier for archaeologists and historians to reconstruct how people lived in cultures that have long since disappeared. Even if a clay artifact has been broken, its **shards** can often be put together again. If the fragments are too scattered, the archaeologist can still study the type of clay in the remaining shards. From the nature of the decoration on the fragments, or the original shape of a pot or sculpture suggested by the preserved sections, it is possible to learn a considerable amount about a society—its degree of technical development, the extent of its trade, and its exposure to migrations of other peoples that may have introduced new ceramics techniques. For example, pottery from 6,000 years ago found in Sian, China, reveals techniques and painted designs similar to those on older pottery

Figure 1-3
Found by the Masada Expedition in Israel, this *ostraca*, or lot, may be one of those used to determine the order of death of the Zealots of Masada, patriots who chose to die by their own hands rather than surrender to the Romans. Masada, A.D. 73. *Courtesy Israel Exploration Society. Photo: Y. Yadin.*

found in Russian Turkistan in western Asia, showing that interchanges occurred among the potters of these areas.

In addition, since most archaeological sites are rich in pot shards, through modern dating methods such as carbon 14 dating the excavator can often establish a pottery sequence that allows the dating of other materials found in the same stratum.

Masada: An Early Drama Revealed

In the 1960s Dr. Yigael Yadin, then professor of archaeology at Hebrew University in Jerusalem, while directing the excavation of a large fortress and palace built by Herod the Great on top of the Rock of Masada, unearthed a clay artifact that evoked a moment of great human drama. In A.D. 73, this rock had been the site of a heroic last-ditch stand made by a thousand Jewish rebels against their Roman rulers. These Zealots of Masada, as they are called, withstood three years of siege, but finally realizing that a Roman breakthrough was imminent, they decided to die by their own hands rather than surrender. Each man first killed his wife and children; the survivors chose ten men by lot to be their executioners. The last ten then drew lots among themselves to decide who would kill the other nine, and this last man finally killed himself.

Almost 2,000 years later, members of the archaeological team at Masada found eleven pottery *ostraca*, or lots, lettered with the names of men (1-3). One of them bore the name of the Zealots' leader, Eleazar ben Ya'hir'.

Clay Artifacts in Burials

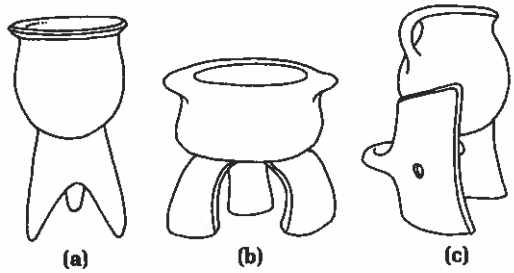
Since ceramic containers do not disintegrate as do those made of wood, it is not surprising that ancient peoples frequently buried their dead in fired clay vessels. They also buried with them small ceramic containers of oils and perfumes and clay reproductions of servants and objects they believed the deceased might need in the afterlife. Through study of these burial finds, archaeologists are able to theorize about a culture's religious beliefs and attempt to reconstruct its daily life. For example, the artifacts discovered in digs can help us visualize the Sumerian doctor dictating a prescription to a scribe (1-4) or the domestic chores of women in an early culture (1-5). Anthropologists can even learn much about the physical makeup of a people from potters' fingerprints preserved in clay (1-6).

The Discovery of Ceramics

We may never be able to set an exact date for when humans first discovered that clay could become hard when exposed to fire, know how that discovery occurred, where it occurred first, nor whether women or men were responsible for the development in all areas. It is generally assumed, however, that in most areas of the world ceramics was discovered in the domestic situation by women. Various theories have been suggested ranging from the building of fires on clay hut floors that baked the clay to hardness, to the accidental burning of a clay-lined basket left too near a fire. However it was discovered, the development of ceramics certainly changed the do-

Figure 1-4
The Sumerians used slabs of damp clay as writing surfaces, and the impression of the marking tool that a clerk pressed into a tablet around 2100 B.C. is still legible. This tablet records the prescription of a local doctor: "Pulverize the seed of the 'carpenter plant,' the gum resin of the markasi-plant, and thyme; dissolve it in beer; let the man drink." *Courtesy the University Museum, University of Pennsylvania (Neg. #55887).*

Figure 1-5
When people learned to make pottery, this technological advance changed cooking methods. Foods no longer had to be roasted over an open fire; they could be boiled in liquids directly over the fire (2-25). Various ceramic vessels and stands made this possible: In ancient China **(a)**, a pot on three legs held liquids; in prehistoric Anatolia **(b)**, the cooks placed casseroles on another form of three-legged stand; while in ancient Greece **(c)**, a stand with a built-in shield protected the fire from breezes and the cook from smoke.



mestic lives of women wherever it occurred, undoubtedly altering the way food was prepared, making it possible to utilize foods that were not edible unless cooked at length in liquid (1-5). Ceramic containers also made for better storage of food.

Trade based on these surplus commodities developed, leading to the exchange of ideas and technologies. Scholars suggest that it was at this point in the development of a society that the craft of pottery became specialized and that the men rather than the women became the potters, producing wares for trade in addition to local use.

Although it has generally been considered that the domestic use of ceramics was the only motivation for the production of pottery, recent excavations where only decorated, nonutilitarian pottery was found have suggested to some archaeologists that the use of pottery to display status was also a motivation for developing ceramics; in this case, the potters may have been men.

Figure 1-6
A potter who lived on Crete about 1,400 years ago left the enduring mark of his thumb in the damp clay of a large *pithos*, or storage jar. Mallia, Crete. *Photo: James McGann.*

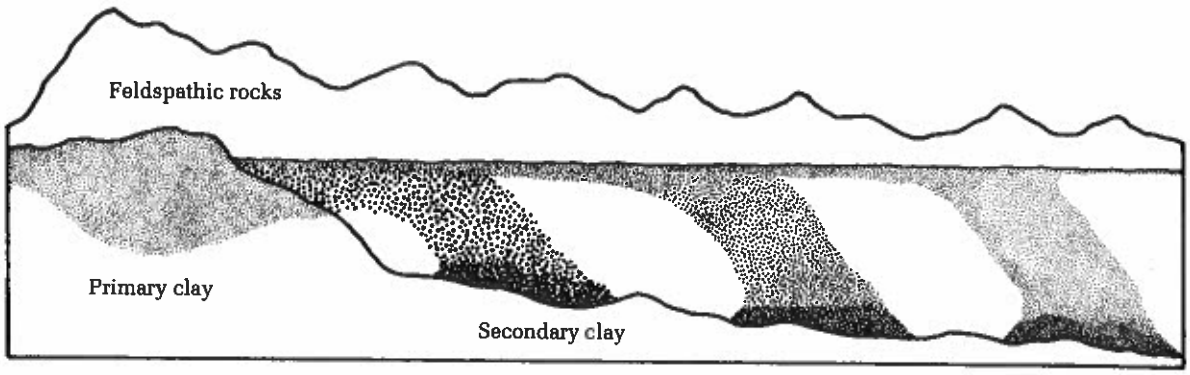


Figure 1-7
Rain, snow, wind, and water wear down the earth's feldspathic rock, causing it to decompose in place to become **primary clay.** Particles are also moved by the action of water to be deposited elsewhere, forming beds of **secondary clay.** Different types of clay such as **stoneware, earthenware,** or **ball clay** are dug from these deposits to be transformed by human hands into vessels or sculptures. *Drawing by John M. Casey.*

THE GEOLOGIC ORIGINS OF CLAY

The earth's surface was formed from melted rock that cooled and solidified. Over millions of years, the weathering action of alternating freezing and thawing, along with the grinding of glaciers, the pounding of rain, the buffeting of wind, the flow of rushing streams, and the probing of tree roots, slowly breaks down the earth's crust into boulders, then into stones, then pebbles, and finally into the small particles that make up different types of clay (1-7). At the same time, chemical changes take place as oxygen combines with minerals to form **oxides.**

The fertile areas of the earth are covered with a layer of topsoil that is rich in rotted organic matter. Under this soil, or sometimes under a layer of rock, lie deposits of various types of clay. You can see these clay beds in highway cuts or at construction sites where they have been exposed by earth-moving machines, and as rivers erode and cut into their banks, they also reveal beds of clay (1-8).

Clay Components

Feldspar, the most abundant mineral on the earth's surface, is an essential component of granite rocks and is the basis of clay. Made up primarily of the oxides **silica** and **alumina** combined with such **alkalies** as **potassium** and some so-called impurities such as **iron,** it is this feldspathic origin of clay that makes it possible to fire objects made of clay to a dense and permanent hardness. Just as the intense heat of a volcano can fuse the elements in certain rocks into the glassy substance obsidian, so can the heat of the fire fuse and transform the mineral components of clay into ceramic. To be capable of producing ceramic, a clay must contain, along with other components, a **flux** and a heat-resistant material, or **refractory.** The amount of flux a clay contains in relation to the refractory material is one factor that controls the point at which a clay reaches its optimum density, or maturity.

TYPES OF CLAY

Ceramists refer to the particular types of clay they use as **clay bodies.** The clay body used may consist of clay as it was found in its natural state, but the term *clay body* usually refers to a combination of materials that the potter, sculptor, or supplier has formulated for a specific purpose. To fuse and mature, each type of clay requires a different heat level and duration in the fire. Some, like low-fired **earthenware** clay, never do become as dense and **vitreous** (glassy) as high-

fired clays like **stoneware** and **porcelain.** The variations in size of the clay particles and the varying temperatures at which clays reach maturity account for the differences in texture and appearance between, say, a white porcelain vase and a reddish flowerpot. Color variations are produced by the presence or lack of coloring oxides such as iron or manganese.

Later chapters contain detailed information about the composition of clays and the appropriateness of each type to a particular type of work, but in the first part of this book we are primarily concerned with understanding how the characteristics of this earth material affected ceramic technology as it developed in various areas of the world.

The Plasticity of Clay

Dampened with water, clay is easy to form, holding together as you shape it. Air-dried, it is fragile, crumbling easily. But when fired to its correct maturing temperature in a fire or a **kiln,** it becomes hard and permanent, capable of keeping its form for thousands of years.

Clay's plasticity when damp is mainly due to the fineness of its particles (or **platelets**), to their flat shape, and to the action of the water between them. In addition, the organic materials that have become mixed with the clay in its journey from rock to riverbed play their part in making it malleable.

When water is absorbed by dry clay, the film it forms between the platelets lubricates them so that they slip against each other, but also makes them cling together, just as smooth pieces of glass both cling to and slide against each other when they are wet.

Clays differ greatly in their degree of plasticity. Some are so sticky they are almost impossible to shape; other clays, which might work well when used in a semiliquid **slip** state for **casting,** would never hold together if used damp for **throwing** on a potter's wheel. Clay that is a joy to shape on the wheel may not be successfully modeled into a large sculpture, so the clay worker must take into account the properties of each clay in relation to the desired results. These variations in clay as well as the local availability of specific clays had an important effect on how the craft of ceramics developed in different areas of the world.

EARLY CERAMICS TECHNOLOGY

Any reconstruction of history involves educated guesses, so we cannot say for certain how the earliest potters actually made their pots. However, experts can learn a good deal about their methods through the microscopic examination of the ceramics found in excavations and the study of methods of potters whose techniques are believed to be similar to those of the earliest cultures. Thus, by watching a village potter in Africa or the American Southwest, we can hope to learn something of the problems encountered and the processes worked out by our earliest potting ancestors.

Gathering the Clay

For the early potter, the first step in making a pot would naturally have been the gathering of the necessary material (1-8). A village potter who had no cart or pack animal would have tried to find a clay source near enough to the village so that she could carry the clay back in baskets or leather bags. Sometimes a particular clay would have to be brought from quite a distance, but pottery was apparently important enough to the village to make even a difficult trip worthwhile. For example, in the Hebrides Islands, off the Scottish coast, in the second millennium B.C., clay and the wood for firing it were scarce, and both had to be fetched from across the open water by dugout canoe.

Early potters, like all agricultural peoples, felt their dependence on the earth. To them the earth was a sacred mother on whom they depended for life and health, and in many cultures the potters would not dig the clay without proper religious observances. In the American Southwest, for example, potters asked the earth's permission to remove the clay before digging it out with a stick. Mothers taught their daughters the required rituals, calling the earth Mother Clay, and to this day, many potters in New Mexico scatter corn on the ground as an offering before digging their clay.

When people first started making pottery, they probably used the clay just as it came from the riverbank or hillside (1-9), merely picking out the larger impurities. Sometimes the clay would be free of impurities and was dug out damp enough so it could be worked immediately. Alternately, dry chunks of clay dug out of banks (1-8, 1-9)

Figure 1-8
The photo shows Julian Martinez digging clay from an exposed bed on a mesa in New Mexico in the 1940s. Maria Martinez recalled that in her grandmother's day the digger always scattered corn as an offering before removing the clay—a custom that many potters still practice in the Southwest. New Mexico, c. 1940. *Wyatt Davis, Courtesy Museum of New Mexico, neg. no. 723. Detail.*

Figure 1-9
After digging and transporting the clay to the village, the early potter sometimes used it as it came from the earth, but this often required cleaning or aging. Chunks of clay, stored outside a workshop in Greece, are drying before being broken up and soaked in water.

could be broken up and softened with water, then spread in the sun to stiffen to working consistency (1-10) ready to use. Potters still find natural clay deposits to test and fire (10–1).

Adding Temper to Clay

At some point, early potters must have discovered that a pot made of coarse-textured clay was less likely to burst or crack in firing than one made of fine-grained clay. This is because the moisture contained in the damp clay can escape more readily through the pores of coarse clay as vapor. Some clays already contain a natural **temper,** such as sand, mica, or volcanic ash. If, however, there was no natural temper, the next step was to add tempering material to the clay and mix it in thoroughly (1-11). Usually, all the potters in an area used the same locally available tempering material, so archaeologists can often tell the origin of a piece of pottery by noting what tempering material was used. For example, around 6000 B.C. in some areas of the Middle East, potters mixed straw in their clay to open the pores, while in certain parts of the American Southwest traditional potters still use volcanic rock or sand as temper.

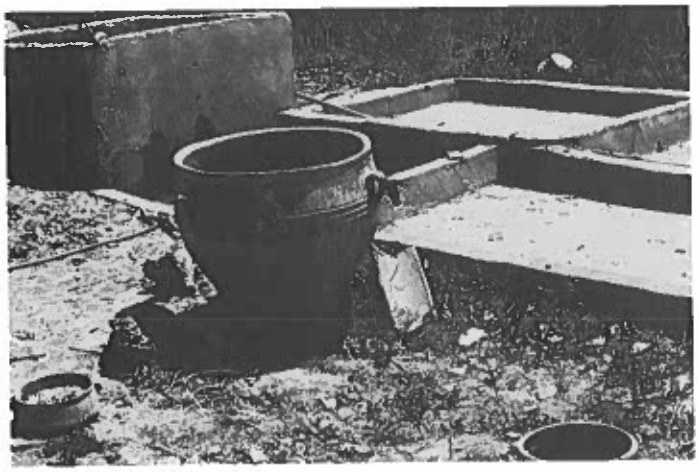
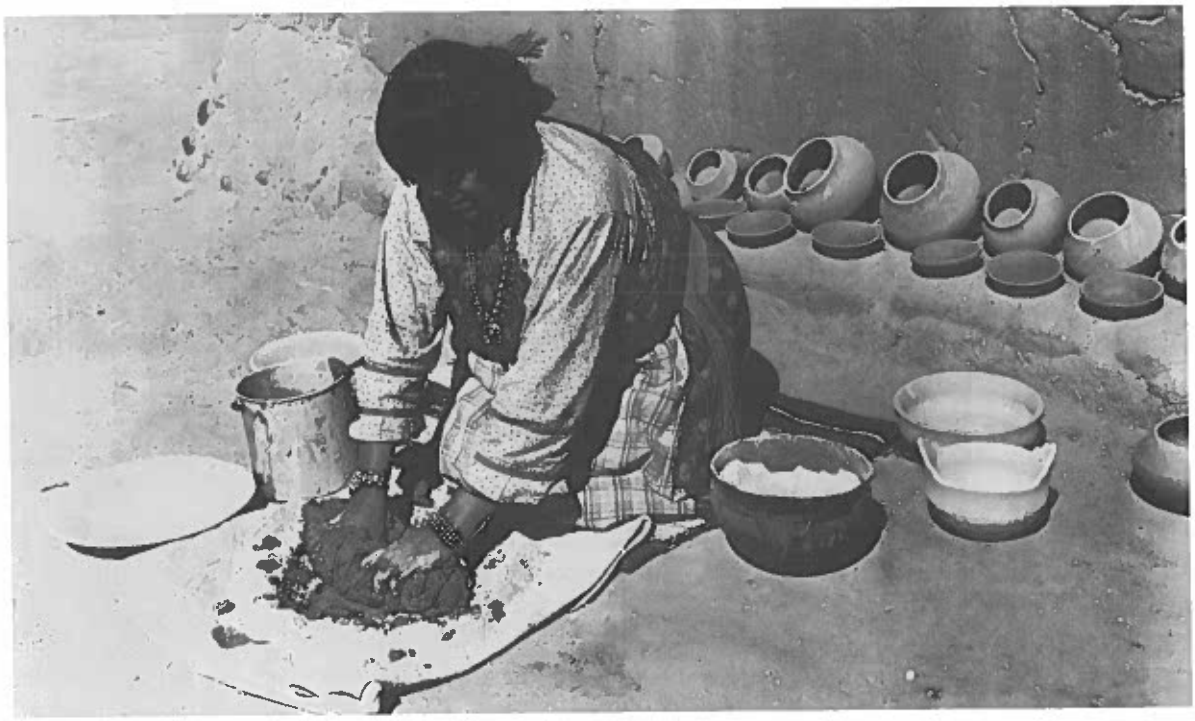


Figure 1-10
After digging, drying, pulverizing, and soaking the local clay, potters in Thrapsanon, Greece, spread it in the sun to stiffen. When it reaches working consistency, they will wedge and store it. This same system can be used to recycle clay.

Figure 1-11
To create beautiful pottery, Maria Martinez needed nothing more than a level spot in the sun. In this photograph taken around 1940, she showed how she moistened her clay, kneaded tempering material into it, and worked it until she had eliminated the lumps or air bubbles. *Photo by Wyatt Davis, courtesy Museum of New Mexico, neg. no. 50085.*



Early Forming Methods

The earliest containers probably were made by women pinching or coiling the clay into shape.

PINCHING If you pick up a lump of clay, let your thumb sink into it, turning it while pinching and pulling up the sides, squeezing and compressing the walls as they grow between your fingers and thumb, you will find it easy to shape the clay into a rough, thick-walled but serviceable pot. However, it takes considerable skill to shape a thin-walled, aesthetically pleasing pot using the pinching method. This is because if the clay is stretched too much during this process, it tends to crack, or the walls may collapse. It is also difficult when pinching to control the shape of the pot—for example, narrowing in a neck from a swelling body or opening it out into a flaring bowl.

COILING The tendency of the clay to collapse might be why early pottery makers devised the **coiling** method in which the walls were built up by adding rolls of clay one at a time usually waiting for the lower ones to stiffen.

It is possible to make a flat-bottomed pot by coiling clay into a flat base, but to form a pot with a rounded bottom, the potter would have been more likely to pat some clay out over a smooth rock or press it into half a dried gourd, a basket, a broken pot, or even a hollow tree stump. In order to keep the damp clay from sticking to this simple **press mold,** the potter might have placed leaves or ashes under the clay. Special baked clay molds were also sometimes used in which to form the base. In the Tewa culture of the American Southwest, these molds were called *puki,* a word that has been adopted into our ceramics vocabulary.

Once a base was formed, the potter rolled out coils between her hands or on a flat surface and then attached them to the base and built up the walls by attaching each coil to the one below (1-12). This is the most common pottery-building method still used in traditional cultures, and it was widely used by the earliest potters.

On occasion, when a pot had been built up of coils or slabs of clay, the potter paddled the walls, forcing the clay particles together, thereby strengthening the walls as well as shaping the pot (1-13).

Figure 1-12
As we look at this woman in New Guinea building a pot on her lap using thick, damp coils, it is easy to imagine how the world's earliest potters pressed chunks and coils of clay together to make roughly constructed pots. Lokanu, New Guinea. *Courtesy Field Museum of Natural History, Chicago (Neg. #32000).*

Figure 1-13
Resting their pots on bases of grasses and leaves, potters in the Fiji Islands form them with flat slabs of clay, which they will later shape through paddling. The paddling will also help to meld the slabs together. *Courtesy Fiji Museum, Suva, Fiji.*

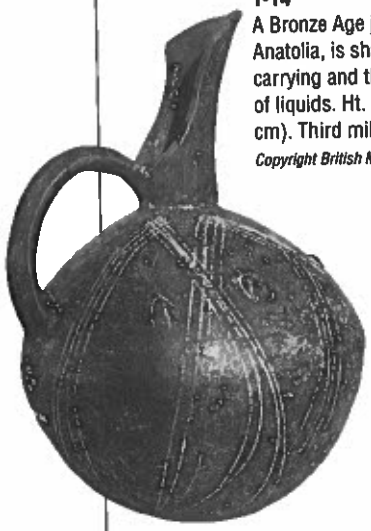
SHAPE

Once potters had learned to make basic vessels, they let their imaginations range, drawing ideas from the world around them. The early potters who lived close to the earth, planting, reaping, sorting, and grinding their food, had responsive fingers, and their pottery reflected this sensitivity. They were also aware of the stances and movements of the animals that shared their lives, so they sometimes shaped their pots into simplified, exaggerated, or distorted images of those furred and feathered creatures (1-16, 1-17, 1-18). Some of the forms were based on containers made from other materials (1-14), while others were humorous adaptations to specific functions (1-15). Still others resulted from the potter's sensitive attention to the relationship between the rim and base of a pot. Even if the early potter was making a vessel to hold a ritual libation, his work could still be lively and inventive within the limits set by tradition, showing keen observation and even humor.

1-17
Bird-shaped pottery vessel from Africa. The neck of the lifelike bird forms the spout, and its head becomes the vessel's stopper. Animal-shaped vessels were often buried with the dead or used for pouring libations at the grave. Ht. 10 in. (25.4 cm). Suto, Lesotho. *Copyright British Museum.*

1-15
The shape of this earthenware feeding vessel is emphasized by the painted face with its pointed nose. Cyprus, tenth or eleventh century B.C. *By courtesy of the Board of Trustees of the Victoria & Albert Museum.*

1-14
A Bronze Age jar from Yortan, Anatolia, is shaped for safe carrying and the easy pouring of liquids. Ht. 9¾ in. (24.8 cm). Third millennium B.C. *Copyright British Museum.*



1-16
A life-like depiction of a domesticated animal as a bull-shaped vessel. Ht. 6⅞ in. (17.4 cm). First millennium B.C. *Copyright British Museum.*

1-18
Potters of the Old Silla dynasty in Korea frequently modeled vessels in the shape of animals or people. Fifth or sixth century A.D. *Courtesy National Museum of Korea, Seoul.*

Sometimes, in the process of making a large pot through coiling, a potter might find that so much clay has been built up on the base that the walls have collapsed under its weight. As a solution, she might build up her next pot only part way and set it aside to harden somewhat before adding more damp clay. Whatever the method of applying the coils, the process of coiling has played an important role in the history of ceramics and is still used by many potters.

Whatever method of shaping was used, as time went on, potters learned to control the clay more competently and were able to mold it into a great variety of shapes (1-14 to 1-18).

FINISHING As the coiled walls rose up under the potter's hands, she would shape and thin the walls and scrape and smooth the inside and outside with a tool made from a natural material—perhaps a piece of dried gourd or a shell. Sometimes this was all the finishing she would do to a pot before it was fired. But if she wanted an even smoother surface, she could **burnish** the clay when it had stiffened to a consistency called **leather hard.** To burnish, the potter took a smooth pebble, a piece of bone, or a shell, and with rhythmic gestures stroked the surface of the pot, polishing the surface to a glossy finish and tightening the clay particles. This works well on natural clay that does not contain large grains of temper, but to burnish the surface of a pot made of coarse clay, the potter might first paint the pot with a coating of fine clay soaked in water—called slip—and then burnish this to a smooth surface (1-19).

However, even this treatment did not make low-fired earthenware watertight, because earthenware clay was not fired high enough to become impervious. So early potters used various methods to try to close the pores of the clay to make it

Figure 1-19
Burnishing with a smooth stone while the clay is stiff but still damp gives the pot an attractive glossy surface. It also serves to press the clay particles together, making the earthenware less porous. Smooth stones, like the one this potter in Ndola, Zambia, is using, were treasured possessions, often handed down through several generations. Ndola Rural. Chipulukusu Compound. *Courtesy Zambia Information Services Department, Lusaka, Zambia.*

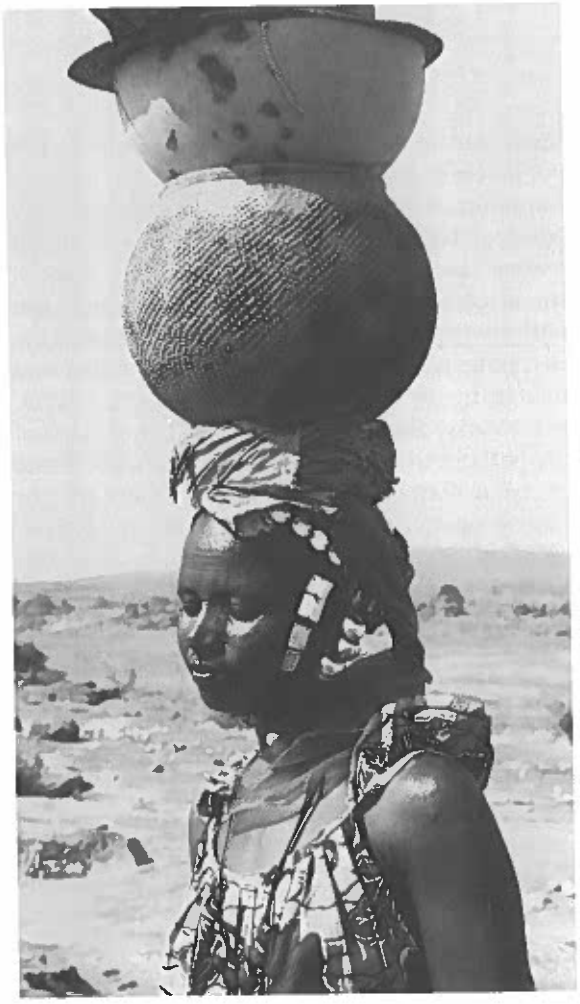


Figure 1-20
The rough texture on the lower pot was probably added to make it less slippery to lift when it was wet. Woman, probably Fulani, in Sanga Region, Mali. *Courtesy National Museum of African Art, Eliot Elisofon Archives, Smithsonian Institution. Photo: Eliot Elisofon, 1970.*

hold water or to give it a smooth surface on which to paint decoration. Sometimes, in an attempt to solve the problem of porosity, potters treated their fired pots with a mixture made by boiling certain plants; alternatively, they coated the still-hot pots with pitch from native trees. Cooking in earthenware over a period of time also helps to make it less porous, as does soaking it for a long time in water. The porosity of earthenware can, however, be an advantage in hot climates, where water is usually stored in unglazed earthenware jars so that evaporation through the pores of the clay cools it.

Decorating the Damp Clay Some pots were left plain or burnished, but others were decorated with a simple decoration of incised lines that the potter scratched into the clay while it was still damp using natural tools chosen to achieve texture and pattern. A fingernail repeatedly pushed into the clay could form a pattern or texture, as could holes poked into it or the serrated edge of a shell combed across the surface. Sometimes this decorative texture served a function, as on a water vessel that would otherwise be slippery or difficult to carry when wet (1-20). The potter's sense of design and awareness of the relationship between a pot's decoration and its shape often showed discernment, control, and aesthetic sensibility. For example, a potter in ancient Japan might decorate his pot with a combination of texture and carving (3-3), while a Bronze Age potter in Scotland might combine simple cross-hatching and horizontal lines into effective decoration (6-2).

The scratched or applied decoration was enriched by the color of the clay body, which could range from buff to reddish, from light to dark brown, or from gray to black, depending on its mineral composition or the firing methods used. Some pots, owing to uneven firing, came out of the fire with dark and light red and black splotches on the outside, a decorative effect still sought by many potters today. Other effects were created by applying earth pigments to the surface of the ware. The artistic eye of an early potter often enabled him to create a pot with decoration that enhanced its surface (1-21 to 1-24).

Early Firing Methods

Whatever method was used to shape the vessel or sculpture, obviously the piece eventually had to be fired before it could be changed into ceramic. The most abundant clay available throughout the world—earthenware clay—could be fired at a comparatively low temperature, reaching maturity in a relatively short time. This was due to the large amounts of iron in it that acted as a flux, making it possible for the refractory components to melt at a low temperature. This low-firing clay body still supplies the bulk of cooking and storage containers in areas where industrial products such as plastics have not taken over the potter's market.

Local clays, local tempering materials, available firing materials, and even local climate had their effect on how a potter worked. Nowadays we can control humidity and drying by artificial means, but the early potter was at the mercy of

1-21
Mesopotamian potters formed their urns and jars in a variety of shapes, many of them decorated with earth colors applied in bold linear patterns that accentuated the curves of the vessels. Ht. 4½ in. (11.5 cm). Nineveh, Mesopotamia, third millennium B.C. *Copyright British Museum.*

Once a pot was finished, the potter often took the time to decorate it, especially if it was to be used for ritual or burial. When clay crafters discovered that certain pigments could make colored decorations on their fired ware, they often washed their pottery over with mineral color or painted it with simple designs using various minerals (1-21). These early painted decorations ranged from stylized human figures, fishes, or birds to intricate abstract patterns. Many of the early painted pots from widely separated cultures carry similar designs, leading some scholars to speculate about a possible common decorative ancestry. Perhaps these symbols did have common origins, but more likely the shapes of the pots themselves suggested the motifs. For example, there is a strong similarity among the spiral designs seen on pots around the world. Painted on an early Egyptian (1-22) or Chinese vessel before 3000 B.C. (1-23), or on a Cretan jar (1-24), the spirals could have had a religious significance, but it is also possible that the potters used these swirls and spirals because their rhythms were particularly appropriate to the curving profiles of the vessels.

1-22
Spirals of purple painted on its surface relate to the bulbous shape of a pot made in Egypt sometime before 3000 B.C. Ht. 7½ in. (19 cm). *Copyright British Museum.*

1-23
Elegantly decorated with spirals painted in red and black, this earthenware vessel was found in a cemetery in Hanzu, China. Ht. 13 in. (33 cm). Pan Shan culture, 2500–1500 B.C. *Courtesy Collection Haags Gemeentemuseum, The Hague.*

1-24
The spiraling, wavelike design on a large urn from the palace at Phaistos carries our eyes around the jar's form. Crete 2000–1700 B.C. © *Heracleion Museum/Archaeological Receipts Fund.*

the climate. In hot, dry Mesopotamia, for example, the work of building up a pot had to be done quickly, before the evaporation of moisture made the clay unmanageable, but that difficulty did not exist for the Bronze Age potter in misty Scotland (6-2). There, getting the pots dry enough to fire safely was the problem, and the potter probably had to dry them beside a fire for a long time before the moisture in their walls was completely driven out.

Open Firing The first earthenware was undoubtedly fired in **open firing,** or in pits, much as it is still done in some villages in Africa, Fiji, and parts of the Middle East and the American Southwest (5-16). Before firing, the potter air-dried the pots and sometimes, to speed the drying process and drive out all the water from the clay, probably burned dried grass or dung inside the containers. This process also heated the pots slowly, minimizing the **thermal shock** that could have caused them to crack in the fire.

Once the pots were thoroughly dry, they were stacked along with the fuel. This might be wood, dung, sugar cane, peat, rice straw, palm fronds, or any combustible material that could be gathered locally in the necessary quantity (1-25).

How to stack the pots, how much straw or wood to use, how long to burn the fire, when to cool the pots were all technical decisions that potters worked out slowly through experimentation.

EVOLVING TECHNIQUES

Because we must depend on excavations to supply information about early forming and firing methods, there are gaps in the story of the development of ceramics. Much of the story is built on conjecture based on studies of traditional methods still in use today, but one thing is certain—later generations of potters built directly on the discoveries made by their potting forebears. In this overview of the beginnings of ceramics, we have compressed thousands of years and the experiments of untold numbers of individual potters in isolated villages around the world. The following chapters continue the story of the development of ceramics technology leading up to contemporary ceramics, which makes use of modern chemistry, space-age kiln insulation, and computer-controlled kilns. No matter how complex modern ceramics has become, however, a handmade pot is still made of decomposed rock and is still formed by human fingers responding with sensitivity to the plasticity of clay.

Figure 1-25
The earliest potters undoubtedly fired their pots in open fires, just as many village potters do today, using a local source of fuel. In Fiji the pots are stacked together with palm fronds and grasses piled over them. Pots undergoing this type of firing can be damaged by gusts of wind that suddenly cause the fire to burn hotter. *Courtesy Fiji Museum, Suva, Fiji.*